

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

| | |
|--|---|
| 2. [Title] | Biotechnology |
| 2. Degree Level | Master |
| 3. [Credits] ECTS (+ semesters) | 120 ECTS |
| 4. Language | Armenian |
| 5. Qualification awarded | Masters in Technology |
| 6. [Level of qualification] | 7 th level (Armenian and EU) |
| 7. Specific admission requirements | ShSU Master degree program can be enrolled by Armenian state and accredited non-state university Bachelor or diploma specialists in a competitive manner. In the scope of the same specialty admission is held without any exams, while with related specialties interview with applicants on related specialty is required |
| 8. Specific arrangements for recognition of prior learning (if any) | N/A |
| 9. [Qualification requirements and regulations] | In order to obtain degree and qualification in Biotechnology, the student has to fulfil the following programme requirements: <ul style="list-style-type: none"> • Acquire general and course specific course learning outcomes • Acquire optional course learning outcomes • Follow a company placement • Prepare and defend the Master's paper |
| 10. [Profile of the programme] | General description <ul style="list-style-type: none"> • Provide professional knowledge on biotechnological fundamental and practical fields, providing the society with professionals with field relevant modern technological skills, who will meet labor market requirements with their theoretical and practical knowledge, will be able to practically apply modern methods of biotechnology, manage scientific projects • Enable students formulate and solve professional related issues during scientific and research activities • Develop students' analytical and coordination competences to work with data related to the biotechnological research processes |

Learning outcomes of the programme

A. Professional knowledge and skills

- Present fundamental and applied problems of microbiology, biotechnology and biochemistry in food biotechnology, describe theoretical basics of microbiological and biotechnological methods peculiarities
- Describe basic concepts of food biotechnology, genetic and cellular engineering, engineering enzymology that are important for biotechnological production
- Describe peculiarities of Armenian flora diversity, patterns based on plant growth metabolism, theoretical basics of plant study biotechnological methods peculiarities, cover the regulatory mechanisms on the basis of secondary metabolism processes
- Present issues of modern approaches to biotechnology and biotechnological products, describe safety, patent issues and ethical norms of biological objects utilization

B. Practical professional skills

- Implement research planning, justification, method choice, presentation of reports on research outcomes
- Apply technological activities, methods, technological means to measure biotechnological process main parameters, to decide raw material and product properties
- Analyze and assess biotechnological methods to study microbes, predict and model systematic and sequential patterns of enzymes, regulate microbes growth and metabolism with various factors, apply metabolic properties of microbes in different products proposing goals and objectives for the research
- Implement activities to obtain plant (medical herb) isolated cultures and biologically active substances, analyze causatives of growing plant antiradical activities in natural conditions, microbes interaction ways, develop business project in the field of biotechnology on the basis of microbes and plant secondary metabolism peculiarities
- Justify rational means of obtaining biologically active additives from raw vegetarian raw materials, medicinal herbal preparations taking into account their types and properties, interpret approaches to obtain wasted and less wasted technologies in biotechnology and food industry
- Master quality control methods of vegetable origin raw material and product used in food industry, assess prospects of technological processes from the aspect of ecological safety and efficiency

C. Generic / transmittable capacities

- Use various sources of information (internet resources, e-libraries, scientific papers)
- Propose new objectives and assess the resources required for their solution
- Apply knowledge and skills in team building and management during research and project activities
- Prepare scientific papers, present research outcomes, conduct scientific debates

11. [Structure of the programme: modules, activities and related ECTS]

- Foreign Language in Professional Sphere (6 ECTS)
- Research Methodology (3 ECTS)
- Food Microbiology (6 ECTS)
- Enzymology (3 ECTS)



- Food Biotechnology (6 ECTS)
- Microbial Biotechnology (3 ECTS)
- Plant Biotechnology (3 ECTS)
- SPSS Statistics (3 ECTS)
- Communication Skills for Professionals (3 ECTS)
- Food and Ecotoxicology (3 ECTS)
- Biosafety and Environmental Risk (6 ECTS)
- Food Biochemistry (6 ECTS)
- Plant Biodiversity and Bioproducts (3 ECTS)
- Probiotic Food Technology (3 ECTS)
- Bioengineering (6 ECTS)
- Management and Marketing in Professional Sphere (3 ECTS)
- Start-up (3 ECTS)
- Pharmacognosy (3 ECTS)
- Herbal Medicinal Preparations Technology (3 ECTS)
- Vegetable Raw Material Bioconversion Technology (3 ECTS)
- Technology of Biologically Active Additives from Vegetable Raw Materials (6 ECTS)
- Research (30 ECTS)
- Scientific Research Practice (9 ECTS)
- Preparation and Defense of Master Thesis (12 ECTS)

UNIVERSITY: Shirak State University
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STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|--|
| 1. N | |
| 2. [Title] | Foreign language in professional sphere |
| 3. [Credits] ECTS | 4 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/per week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Practical work - 32 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> Improve students' language knowledge, develop corresponding communication skills in the professional sphere |
| 11. [Module brief content] | <ol style="list-style-type: none"> Language <ul style="list-style-type: none"> Learning Languages Language and Texting Disappearing Languages Professionally oriented texts <ul style="list-style-type: none"> Environment and Ecology Environmental Pollution Advertising <ul style="list-style-type: none"> Ways of Advertising Advertising and Children Professionally oriented texts <ul style="list-style-type: none"> The Ecosystem Ecological problems of Lake Sevan |



3. Business

- In Business
- Business Dilemmas
- Business Icons

Professionally oriented texts

- Government Action, Private Organizations
- British Environment

4. Personality Types

- Personality Types
- Measuring Personality (Carl Yung)
- Charisma
- Personality Clash

Professionally oriented texts

- Medicine 'Deliver then depart'
- Coronary Arteries
- First By A Head
- Physicians and Interpreters

5. Travel

- Travel and Tourism
- Explorers
- The Empty Quarter

Professionally oriented texts

- The Body and Health
- Medicine and Technology
- Medicine and Technology 'Text B'
- HIV and its results

6. Work

- Homeworking
- Killer Questions
- Situation Vacant

Professionally oriented texts

- The Most Powerful Computer in the Universe
- Are smokers Junkies?
- NHS – The National Health Service
Life Insurance

12. [Learning outcomes of the module] DUBLIN descriptors

a. Professional knowledge and skills

- Be able to translate professional texts from English into Armenian and from Armenian into English



b. Practical professional skills

- Be able to understand general meaning of the professional text, answer the questions. To be able to discuss, debate on some professional issues.

c. Generic / transmittable capacities

- Know the importance of “English of special purposes”, its general meaning and distinguished features from “General English”

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Individual and team work
- Seminar discussions
- Combination of CDs’ with professional texts

14. Assessment methods and standards

- Individual work
- Final examination: oral exam with 3 questions (30,30,40 points). The number of points is 5

15. Main literature/references

1. Cotton D., Falvey D., Kent S. Language Leader Intermediate Coursebook, Pearson Education Limited 2010
2. Hughes J. Language Leader Intermediate Workbook, Pearson Education Limited 2010
3. “Developing Translator’s skills” M. Araratyan, A. Alanakyan, E. Nazlukhanyan, 1999

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|--|
| 1. N | |
| 2. [Title] | Research Methodology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/ week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 14 Practical work – 8 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Deepening and developing knowledge in the field of theoretical and experimental research methodology • Development of planning and implementation of research works, presentation of scientific and technical documentation of received data • Acquisition of knowledge and skills in the field of chemo technical, biochemical and microbiological control of biotechnological processes |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Methodology of theoretical researches 2. Methodology of experimental researches 3. Types of research, goals and objectives, their substantiation and formulation 4. Methods of development of scientific information (essay, article, report, etc.) 5. Students' self-employment forms and types 6. Research planning, logistics (equipment) 7. Physicochemical methods of research in biotechnology 8. Electrochemical methods of research in biotechnology 9. Microscopic and centrifugal methods of analysis |
| 12. [Learning outcomes of the module] DUBLIN descriptors | |
| <i>a. Professional knowledge and perception</i> | |

- Describe the basic methods of experimental research in biotechnology
- Present the methodology and principles of modern science
- Describe analytical hints, references, document formulation, competition rules of participation in scientific projects
- Define the rules for productivity of devices in accordance to the technical passport data, instructions and safety norms

b. Practical professional skills

- Conduct methodological substantiation and planning of scientific research
- Independently learn new research methods
- Carry out the results of scientific research and to formulate conclusions

c. Generic/ transmitted capabilities

- Use modern information technology capabilities for formulating the results of their work

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work
- Experimental data analysis through computer programs

14. Assessment methods and standards

- Individual work
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5.

15. Main literature/references

1. T.V. Meledina, M.M. Danina. METHODS OF PLANNING AND TREATMENT OF RESULTS OF RESEARCH Tutorial Saint Petersburg-Petersburg National Research University of Information Technologies, Mechanics and Optics, 2015
2. Statistical analysis and theory of experiment planning: study guide / N.I. Sydneyev. - Moscow: Publishing House MSTU. N.E. Bauman, 2017. - 195
3. Kuznetsov I.N. Fundamentals of Scientific Research [Electronic resource]: studies. manual for bachelors / I.N. Kuznetsov. - M.: Dashkov and K, 2013 - 283 p. - Access mode: <http://www.knigafund.ru/books/164452> (EBS "BookFund")
4. Ruzavin G.I. Methodology of scientific knowledge [Electronic resource]: studies. Manual for universities / G.I. Ruzavin. - M.: Unity-Dana, 2012 - 287 p. - Access mode: <http://www.knigafund.ru/books/149317> (EBS "BookFund")
5. Creswell, J.W. (2008). Educational research: Planning, conducting and evaluating quantitative and qualitative research (3rd). Upper Saddle River, NJ: Prentice Hall.

UNIVERSITY: Shirak State University
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MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Food Microbiology |
| 3. [Credits] ECTS | 6 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 4 hours/a week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total)) | Lecture - 28 Practical work - 14 Seminar – 8 Laboratory works - 10 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Introduce the productions based on the utilization of microbes • Introduce the fundamentals of microbiology of food production, modern methods of canning and extension of protection and preservation dates of food products, the role of microbes in the process of food protection and recycling • Show the importance of microbiological controls, analyze sanitary of food products, compare national and international sanitary-hygienic requirements |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Microbiology of Food production and its objectives 2. Microbes and food as the source for microbes 3. Factors promoting growth and vitality of microbes 4. Microbiology of food protection and preservation 5. Microbiology of raw material 6. Microbiology of food production and health 7. Pathogenic microbes, food poisoning and diseases 8. Vegetable origin food microbiology (alcoholic drinks) 9. Bread production microbiology 10. Milk and milk product microbiology 11. Meat and meat production microbiology 12. Microbiological examination of food products |

13. Microbiological qualification of food production and its control

14. Sanitary-hygienic requirements to public caring companies

12. [Learning outcomes of the module] DUBLIN descriptors

a. Professional knowledge and skills

- Clarify various food productions through microbes, apply them all microbiological methods to control the quality of food products
- Evaluate the peculiarities of microbial metabolism in various productions
- Justify sanitary-microbiological aspects of food production
- Explain safety criteria of raw and ready-made food products

b. Practical professional skills

- Conduct microbiological research of food products
- Explain research results and assess the quality of food product in accordance with microbiological indicators
- Control the microbiology of food products during the production process
- Evaluate pathogenic microbes danger in food products
- Apply food preservation methods

c. Generic / transmittable capacities

- Analyze experimental results, facts and make justified conclusions

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work
- Seminar discussions, individual and group works

14. Assessment methods and standards

Գնահատման մեթոդները և չափանիշներն են.

- Individual work (essay, presentation)
- Final examination: oral exam with 4 questions each 25 points (with one practical question). The number of points is 5

15. Main literature/references

1. Колычев Н.М., Госманов Р.Г., Кабиров Г.Ф., „Санитарная микробиология пищевых продуктов” Учебное пособие для вузов. Из-во лань, 2015, 560с
2. Ефимочкина Н.Р, Микробиология пищевых продуктов и совр еменные методы детекции патогенов, М.: Издательство РАМН, 2013, 518с
3. Л. В. Красникова, П. И. Гунькова „Общая и пищевая микробиология продуктов” Учебное пособие для вузов , Часть 1,2, -СПб,, Университет ИТМО Санкт- Петербург 2016.-263с
4. Bibek Ray, ArunBhunia „Fundamental Food Microbiology”, 5th Ed., CRC press, 2013, 663p.
5. Jay.James M., Loesner, Martin J., Golden, David A. „Modern Food Microbiology” 7th Ed., , 205, 745p.

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|---|--|
| 1. N | |
| 2. [Title] | Enzymology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/a week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. distribution of hours for module activities (lectures, laboratory works, practical etc (% on total) | Lecture - 16 Practical work – 4 Seminar - 4 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> Introduce knowledge about enzyme fundamental role which falls in the foundation of the vital activity of living organisms and their implementation methods in practice Present involvement of enzymes in the main metabolic pathways and chains, general patterns of energy modification and regulation of the processes Form scientific outlook among the students in the sphere of biochemistry vital processes, to study structure-properties-biological functions interconnection patterns |
| 11. [Module brief content] | <ol style="list-style-type: none"> Enzyme general description as a biocatalyst Enzyme classification. Chemical nature and structure of enzyme Kinetics of enzyme reaction. Mechanism of enzyme reactions Enzyme activity regulation mechanism Enzyme obtaining and purification methods Location of enzyme (cell, tissue). Enzyme usage in practice and development of enzymology |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p><i>a. Professional knowledge and skills</i></p> <ul style="list-style-type: none"> Describe enzyme molecule spatial structure forming principles and explain enzyme involvement in various metabolic pathways |



- Show general principles of enzyme classification and nomination
- List and justify enzyme reaction kinetics main rules
- Show enzyme catalysis stimulation and prevention processes

b. Practical professional skills

- Study enzyme biochemical, kinetic and structural peculiarities
- Summarize gained knowledge and use it for analyzing research results

c. Generic / transmittable capacities

- Analyze the facts and make justified conclusions

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lecture
- Practical and laboratory works
- Seminar discussions
- Experimental data analysis with computer programs

14. **Assessment methods and standards**

Գնահատման մեթոդները և չափանիշներն են.

- Individual work (essay, presentation)
- Final examination: oral exam with 4 questions each 25 points. The number of points is 5.

15. **Main literature/references**

1. Ферш Э. Структура и механизм действия ферментов / Э.Ферш. - М.:Мир, 1980.
2. Варфоломеев С.Д. Химическая энзимология / С. Д. Варфоломеев. - М.: академия/Academia, 2005.
3. Польшанина Г.В. Определение активности ферментов / Г.В. Польшанина, В.С. Чередниченко, Л.В. Римарева. - М.: ДеЛи принт, 2003.
4. Безбородов А.М. Ферментативные процессы в биотехнологии / А.М. Безбородов., Н.А. Загустина., В.О. Попов. - М.: Наука, 2008.
5. Биохимия: Учебник для вузов / под ред. Е.С. Северина. - М.: ГЭОТАР-Медиа, 2006.
6. www.chem.qmul.ac.uk/iubmb - Биохимическая классификация и номенклатура ферментов на сайте Международного союза биохимии и молекулярной биологии
7. www.molbiol.ru – сайт практической молекулярной биологии.
8. www.swissprot.com – свободный доступ к международной базе данных по первичным и 3D структурам ферментов.

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Food Biotechnology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 4 hours/ a week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 28 Practical work – 16 Seminar - 8 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Introduce students the basics of food biotechnology, the biological value of food product and their production technologies • Provide knowledge and skills on the application of biotechnological processes, methods in the food industry and their significance in the formulation of consumer properties of food |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Food biotechnology and its problems. 2. Application of biotechnology in food industry, food as a basis for healthy nutrition 3. Bioproducts used in the production of food 4. Biotechnological basics of vegetable raw material processing, characteristics of vegetable raw materials 5. Application of microbial bioconversion, enzymes, sugarcane, mold and microbe in food industry 6. Technology of bread production 7. Confectionery production technology 8. Yeast based production, alcoholic production: wine, beer, alcohol 9. Beverage production technology 10. Tea production technology |

11. Nutritional acid technology, nutritional additives
12. Biotechnological processes in the production of dairy products
13. Meat and meat products biotechnology
14. Meat, fish and vegetable canned food biotechnology
15. Biotechnology of food protein production

12. [Learning outcomes of the module] DUBLIN descriptors

a. Professional knowledge and perception

- Introduce basic and traditional technological processes and methods used in food industry
- Show the biological value of food and present their production technology

b. Practical professional skills

- Select technical means and rational scheme of biotechnological production of the target material
- Evaluate production technology efficiency
- Carry out technical and sanitary-microbial control in food production
- Determine the conditions of pathogenic microbes infections and their abolishing capabilities
- calculate the main indicators of biotechnological processes and evaluate the future of biotechnological processes from ecological system security perspective

c. Generic/ transmitted capabilities

- application of theoretical knowledge into practice

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work
- Seminar discussions, individual and group work

14. **Assessment methods and standards**

- Individual work (abstracts, presentation)
- Final examination: oral exam with 4 questions each 25 points (with one practical question). The number of points is 5

15. **Main literature/references**

1. Food biotechnology products from raw materials grow. Origin. Textbook. / OA Neverova, A. Yu. Prosekov et al. - Moscow: SIC INFRA-M, 2014. – 318 pages.
2. Ivanova L.A., Voino L.I., Ivanova I.S. Food Biotechnology.
3. Processing of vegetable raw materials: Textbook and studies. Manuals for university students / Ed. THEM. Gracheva. - M.: KolossS, 2008. - 472 pages.
4. Becker ME, Liepins G.K., Raipoulis E.P. Biotechnology. - M.: Agropromizdat, 1990. - 334 pages.
5. Golubev V.N., Zhiganov I.N. Food Biotechnology. - M.: Deliprint, 2001.– 123 pages.
6. Biotechnology: In 8 books. / Ed. N.S. Egorova, V.D. Samuilova. - M.: Higher wk, 1987. -. Proc. : book 1 1-8 - 159 pages; book 2 - 206 pages; book 3 - 127 pages; book - 112 pages; book 5 - 140 p pages; book.6 - 142 pages; book 7 - 158 pages; book 8 – 142 pages.
7. Biotechnology. Principles and application: Trans. from English / Ed. I. Higgins, D. Best, J. Jones. - M.: Mir, 1988. - 480 pages.



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UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Microbial Biotechnology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 3 hours/a week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 20 Practical work - 14 Seminar – 5 Laboratory works - 6 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Provide students advanced knowledge about the current problems of microbial biotechnology and their solutions • Introduce the concepts of microbial biotechnology, as well as modern research methods used in this field • Clarify the possibilities of using microbes in biotechnology |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Introduction, main subject and problems of microbial biotechnology 2. Formation of procaryotic cells, physiological, biochemical and genetic peculiarities 3. Biotechnological approaches: material and energy balance for microbes biomass obtaining 4. The main directions of microbial biotechnology 5. Microbes and obtaining of beneficial substances 6. Obtaining primary and secondary metabolites 7. Bioconversion of microbes 8. Fermentation technology 9. Application of microbes in the food industry, medicine and pharmacy |
| 12. [Learning outcomes of the module] DUBLIN descriptors | |
| <i>a. Professional knowledge and perception</i> | |

- Describe the organization of physiological, biochemical and genetic features of the procaryotic cells
- Describe biophysical and biochemical processes in microbes and their significance in biotechnology
- Present the methods of microbial growth and the effects of various physicochemical factors on the growth of cultivations

b. Practical professional skills

- Analyze modern biotechnology methods and approaches
- regulate the growth of microbes by different factors
- explain the microbial application and the importance of biotechnological methods in various industries
- apply microbial cultivation methods

c. Generic/ transmitted capabilities

- Application of theoretical knowledge into practice

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Pactical and laboratory work
- Seminar discussions, individual and group work

14. **Assessment methods and standards**

- Individual work (abstracts, presentation)
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5

15. **Main literature/references**

1. Becker ME, Liepins G.K., Raipoulis E.P. Biotechnology. - M.: Agropromizdat, 1990. - 334 pages
2. Biotechnology: a textbook for higher. Ped Prof. Education / S.M. Klunova, T.A. Yegorova, E.A. zhivukhina. - M. Akakdemiya Publishing Center, 2010. - 256 pages
3. Biotechnology: In 8 books. / Ed. N.S. Egorova, V.D. Samuilova. - M.: Higher School. 1987. - 1-8 book. Book.1 - 159 pages; Book.2 - 206 pages; Book.3 - 127 pages; Book.4 - 112 pages; Book.5 - 140 pages; Book.6 - pages;; Book.7 - 158 pages; Book.8 - 142 pages.
4. Biotechnology. Principles and application: Trans. from English / Ed. I. Higgins, D. Best, J. Jones. - M.: Mir, 1988. - 480 pages.
5. Sparrows L.M. Technical Microbiology. - M.: Higher School, 1987.
6. M.E. Becker Biotechnology of microbial synthesis. - Riga, 1984

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Plant Biotechnology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 3 hours/ a week |
| 6. [Semester] | 1 st semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 20 Practical work – 8 Seminar -7 Laboratory works - 10 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Introduce modern technologies of making new agricultures, increasing of their productivity, sustainability of unfavorable factors of the environment • Introduce quality requirements for herbal products based on cellular, gene engineering methods |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Biotechnological production of cell cultures, tissues and organs 2. Sterile laboratory work peculiarities 3. Reproduction biotechnology of micro cloning species, genetic engineering 4. Types of nutrients and description of their composition 5. In- vitro bank and cryoconservation, their role in the protection of plant genofond 6. Hormonal regulation in cell cultures and tissues 7. Plant protection microtechnologies for pests and diseases |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p>a. Professional knowledge and skills</p> <ul style="list-style-type: none"> • Introduce fundamental aspects of community needs provision and solution for high quality and safe plant productions • Explain the peculiarities of plant production based on cellular, gene engineering methods, plant microcloning biotechnology through modern methods of gene engineering • Analyze mechanisms of enhancement of the potential of plant adaptation and productivity |

in symbioses with microorganisms

b. Practical professional skills

- Implement activities to acquire plant isolated cultures and biologically active substances
- Analyze causatives relationship of antiradical activity of plants growing in normal and stressful conditions, ways of social interactions of microbes
- Microtechnological methods of plant protection from pests and diseases

c. Generic / transmittable capacities

- Utilize various sources to get the required information

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Discussions
- Seminars
- Laboratory works
- Group works

14. Assessment methods and standards

- Oral examinations
- Individual work

15. Main literature/references

1. Бутенко Р.Г. Биология клеток высших растений *in vitro* и биотехнологии на их основе: Учеб. пособие.– М.: ФБК-ПРЕСС, 1991. – 160 с.
2. Калинин Ф.Л., Кушнир Г. П., Сарнацкая В.В. Технология микрклонального размножения растений – Киев: Наукова думка, 1992.
3. Основы биотехнологии: Учеб. пособие для высш. пед. учеб. заведений / Т.А. Егорова, С.М. Клунова, Е.А. Живухина. – М.: Издательский центр «Академия», 2003. – 208 с.
4. Сельскохозяйственная биотехнология: Учеб./В.С. Шевелуха, Е.А. Калашникова, С.В. Дегтярев и др.: Под. ред. В.С. Шевелухи. – М.: Высш. шк.,199 – 416.

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|---|---|
| 1. N | |
| 2. [Title] | SPSS Statistical |
| 3. [Credits] ECTS | 6 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 3 hours/ a week |
| 6. [Semester] | 2 nd semester |
| 7. Teacher/reference person | |
| 8. distribution of hours for module activities (lectures, laboratory works, practical etc (% on total) | Lecture - 18 Laboratory works - 30 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Provide participants with a basic knowledge of the program to enable the utilization in a socio-economic context and in the exploration of corporate data • Introduce the project toolbar and the basic application techniques • Perform data entry and editing, variable recoding, descriptive analyses with SPSS • Perform simple regressions and multivariate analyses (factor and cluster) |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Introduction. Basic statistical concepts 2. General description of SPSS. Definition of parameters. Saving of results 3. Basic structure of IBM SPSS Statistics. Data files. Using the Editor. Defining Data. Examples files 4. Output management. Reading Data from Spreadsheets. Reading Data from a Database 5. Handling missing data. Missing values for a numeric variable 6. Data manipulation. Data transformation 7. Existent data transformation 8. Merging of different files 9. Data collection. Data restructuring 10. Creating and editing charts 11. Algorithms and diagrams of frequencies 12. Algorithms of descriptive statistics |

13. Factor analysis and chi-square
14. Correlation analysis
15. The coefficients of partial correlation
16. Determination of averages
17. Comparison of average values. T-test
18. Non parametric criteria
19. One-way factor dispersion (standard deviations, minimum, maximum)- ANOVA
20. Multiple dispersive analysis
21. Regression analysis
22. Cluster analysis

12. [Learning outcomes of the module] DUBLIN descriptors

a. Professional knowledge and skills

- Understand the main features of SPSS
- Use the SPSS GUI effectively
- Perform descriptive analyses with SPSS
- Perform common parametric and non-parametric tests
- Perform simple regressions and multivariate analyses

b. Practical professional skills

- Make a research or test, separate and analyze the results
- Manage the skills and capabilities of downloading and analyzing different types of data in the SPSS program

c. Generic / transmittable capacities

- Analyze facts and making justified conclusions

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Laboratory works
- Experimental data analysis through computer programmes

14. **Assessment methods and standards**

- Individual work (abstracts, presentation)
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5

15. **Main literature/references**

1. Наследов А. IBM SPSS Statistics 20 и AMOS: профессиональный статистический анализ данных. — СПб.: Питер, 2013. — 416 с.
2. Quintero, Dino; et al. "Workload Optimized Systems: Tuning POWER7 for Analytics". Abstract.
3. Nie, Norman H; Bent, Dale H; Hadlai Hull, C (1970). "SPSS: Statistical package for the social sciences".
4. "What's New in SPSS Statistics 25 & Subscription - SPSS Predictive Analytics". SPSS Predictive Analytics. 18 July 2017. Retrieved 15 December 2017.
5. "IBM SPSS Data Collection Divestiture". 2 February 2016. Retrieved 7 June 2017.

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|--|
| 1. N | |
| 2. [Title] | Food and Ecotoxicology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/a week |
| 6. [Semester] | 2 nd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total)) | Lecture - 16 Practical work - 4 Seminar – 4 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Develop knowledge and skills on main classes and principles of ecotoxicants and food • Introduce knowledge on main toxicants of environment and agricultural products, their side effects and risks on human organism • Introduce toxicant mechanisms effecting on living organisms |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Basics of general Toxicology 2. Identification of ways and methods of toxicants 3. Toxic impact mechanisms 4. Toxic impact types and levels 5. Dose-response assessment 6. Private Toxicology basics 7. Toxicology risk assessment 8. Qualitative and quantitative assessment methods of risk 9. Assessment of environment in agricultural products systems 10. Pesticides risk management |
| 12. [Learning outcomes of the module] DUBLIN descriptors | |
| <i>a. Professional knowledge and skills</i> | |



- Describe main types and levels of toxicants in environment and living organisms, their properties
- Recognize mechanisms of toxic effects of toxicants on living organisms and environment, as well as dose-response relations

b. Practical professional skills

- Apply main rules and principles of side effect reduction of toxicants on living organisms and environment
- Master qualitative and quantitative methods of the risk
- Apply safety rules, implement necessary activities in case of poisoning

c. Generic / transmittable capacities

- Analyze facts and make conclusions

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Discussions
- Practical and laboratory work
- Laboratory and group works

14. **Assessment methods and standards**

- Individual work (essay)
- Final examination: oral exam with 4 questions each 25 points (with one practical question). The number of points is 5.
- Mid-term exam: written, theoretical questions
- Final exam: oral

15. **Main literature/references**

1. Куценко С.А./Основы токсикологии.ЦПБ. Фогиант 2004г. 715с.
2. Гускова Т.А. /Токсикология лекарственных средств, 2003г. 154с.Альберт А. *Избирательная токсичность*, Т.1 и 2, М.: Медицина, 430с. и 432с., 1989.
3. Colborn T., Dumanoski D. and Myers J.P. *OurStolen Future*. London: Abacus, 306p., 1999.
4. Walker C.H., Hopkin S.P., Sibly R.M. and Peakall D.B. *Principles ofEcotoxicology*, 3rd edn., CRC Press, 344p., 2005

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Biosafety and Environmental Risk |
| 3. [Credits] ECTS | 6 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 3 hours/a week |
| 6. [Semester] | 2 nd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 24 Practical work - 12 Seminar – 12 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Introduce the concept of biological safety from scientific, ecological and social-economic and legal perspectives, to present theoretical and practical knowledge on biological safety, plant genetic resource preservation and their sustainable utilization strategy and approaches • Introduce qualitative assessment principles of technogen systems, as well as possible negative effects caused by emergency situations that influence on the environment. Develop comprehensive approach that will allow to reduce the effect of negative factors on human beings and the environment |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Genetic resources of plants and their significance 2. Methods of obtaining of genetically modified organisms (GMO) 3. The influence of GMOs on the equilibrium of ecosystems and potential risks 4. GMO potential risk assessment and management 5. GMO risk assessment methods, risk algorithms and conceptual models 6. Genetic erosion and its assessment methods 7. Preservation of plants genetic resources, agrobiodiversity 8. Application of biotechnology in the study of plant biodiversity and preservation 9. Natural hazards 10. Technogen systems and their influence on human beings and the environment |

| |
|--|
| <p>11. Quantitative assessment of dangerous influences</p> <p>12. Risk analysis</p> <p>13. Methods of ecological risks of environmental pollution</p> |
| <p>12. [Learning outcomes of the module] DUBLIN descriptors</p> <p>a. Professional knowledge and skills</p> <ul style="list-style-type: none"> • Know classification principles of plant resources • Clarify the role of plant resources and their influence on various fields of human activities • Present main ways of genetic architecture • Assess genetically modified plants and their influence on ecosystem • Assess ecology of genetically modified organisms, food safety and agricultural risks, ecological risk factors and ecological adaptation capabilities <p>b. Practical professional skills</p> <ul style="list-style-type: none"> • Develop monitoring plan for risk assessment of genetically modified organism in the ecosystem • Implement qualitative and quantitative detection of genetically modified organisms in food • Conduct main methods of ecosystem analysis and mathematical modeling • Apply professional skills for development of preventive measures of ecological crisis situations <p>c. Generic / transmittable capacities</p> <ul style="list-style-type: none"> • Apply various sources to receive necessary information • Analyze facts and make conclusions • Maintain professional ethics |
| <p>13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)</p> <ul style="list-style-type: none"> • Lectures • Discussions • Practical work • Seminar discussions, individual and group works |
| <p>14. Assessment methods and standards</p> <ul style="list-style-type: none"> • Final examination: oral exam with 4 questions each 25. The number of points is 5. • Individual work |
| <p>15. Main literature/references</p> <ol style="list-style-type: none"> 1. Current status and options for crop biotechnologies in developing countries, 2010, FAO, Rome, 65pp. GM food safety assessment, 2009, FAO, Rome, 203 pp. Foods derived from modern biotechnology, Second edition, 2009, WHO and FAO, Rome, 85pp. 2. Mackenzie, Ruth, Burhenne-Guilmin, Françoise, La Vina, Antonio G. M. and Werksman, Jacob D. in cooperation with Ascencio, Alfonso, Kinderlerer, Julian, Kummer, Katarina and Tapper, Richard(2003). An Explanatory Guide to the Cartagena Protocol on Biosafety. IUCN, Gland, Switzerland and Cambridge, UK. 295pp. 3. Guidance document of the scientific panel on genetically modified organisms for the risk assessment of genetically modified microorganisms and their derived products intended for food and feed use, 2006, EFSA, Italy, 121 pp. |

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Food Biochemistry |
| 3. [Credits] ECTS | 6 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 3 hours/a week |
| 6. [Semester] | 2 nd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 24 Practical work - 10 Seminar – 12 Laboratory work - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Establish systematic knowledge of metabolic biochemistry and appropriate nutrition principles for human health • Provide knowledge of human nutrition-related biochemical processes • Form an idea about the importance of nutrition for the body's normal metabolic process |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Biochemistry of nutrition and nutritional characteristics of different age groups 2. Main food compositions and their significance 3. Nutrition biochemistry 4. Biochemical characteristics of human digestive system 5. Absorption of the substances in the intestine and the configuration of digestion 6. Organic substances as an important source of energy in the organism 7. Obesity, nutritional dependence, mechanisms of its occurrence 8. Biochemical ways of protein, lipid, carbohydrate transformation 9. The role of proteins in human diet, their nutrition value 10. Animal and vegetative origin proteins and their combination in different diets 11. Lipids, sources of lipids and biochemistry of their digestion 12. Nutritional sources of carbohydrates and biochemistry of their digestion 13. Vitamins, their classification |

14. The role of vitamins in metabolic channels
15. Under and overuse of vitamins
16. Mineral salts, microspheres and their roles in metabolism
17. Principles of human nutrition, balanced diet principles, nutritional pyramids
18. Biologically active additives, the use of GMOs, the possible advantages and disadvantages of their usage

12. **[Learning outcomes of the module]** DUBLIN descriptors

a. Professional knowledge and perception

- Introduce the basic principles of food biochemistry
- Describe the basic nutrition principles that contribute to normal metabolism and health care in the body
- Introduce the main ingredients of food, their composition and their significance for the human body
- Show the basic patterns of nutrition and describe disorders caused by breastfeeding disorders and ways to overcome them

b. Practical professional skills

- Evaluate the quality of food and plan nutrition based on theoretical knowledge
- Interpretation of interaction between food ingredients and metabolism of the organism
- Assess the presence of dangerous additives in the food of the first necessity

c. Generic/ transmitted capabilities

- Apply theoretical knowledge into practice

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work
- Seminar discussions, individual and group work

14. **Assessment methods and standards**

- Individual work (abstracts, presentation)
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5

15. **Main literature/references**

1. Biochemistry: a textbook / Ed. E.S. Severin. 5th ed., Rev. and add. 2012. – 768 pages.
2. E.A. Stroyev, Biological chemistry” Moscow, Higher School” 1996. -490pages
3. Marie, R., Grenner, D., Meies, P., Rodwell, V. Human Biochemistry. In 2 volumes. M., 1993
4. I.A. Rogov, L.V. Antipova, N.I. Dunchenko, Food Chemistry, Moscow, 2007, 855pages
5. Toxicological chemistry. Analytical Toxicology: textbook + CD. Eremin S.A., Kaletin G.I., Kaletina N.I. et al. / ed. RU. Khabrieva, N.I. Kaletina. 2010. - 752 pages
6. Nelson D, Cox M. Basics of Leninger's biochemistry, in 3 volumes., Moscow, Beanom, 2015, 448 pages

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Plant Biodiversity and Bioproducts |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/a week |
| 6. [Semester] | 2 nd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 16 Practical work - 4 Seminar – 4 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> Introduce knowledge on general characteristics of Armenian flora, diversity and peculiarities of flora, research methods, their rational utilization and protection |
| 11. [Module brief content] | <ol style="list-style-type: none"> Introduction to biodiversity, assessment and measurement Human influence on biodiversity Biodiversity development ways in Armenia Natural resources in Armenia. Armenian flora Armenian biodiversity protection, levels of protection Armenian regulation on flora Requirements for plant and flora protection Vegetable product recruitments peculiarities |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p>a. Professional knowledge and skills</p> <ul style="list-style-type: none"> Introduce plants diversity studies in Armenia Explain main historical phases of Armenian vegetation, modern reasons for flora taxonomic diversity change Analyze reasons for Armenian vegetation formation, recognize and classify Armenian vegetation according to their zonality Present Armenian flora protection regulations, Armenian “Red Book” |



- Present phytosanitary rules for plants and plant products

b. Practical professional skills

- Differentiate, compare and interpret Armenian flora territories and their vegetation
- Apply various flora study methods to conduct field and laboratory research
- Explain main principles of planet, particularly Armenian flora distribution and overturning
- Explain phytosanitary rules and requirements, as well as Armenian regulation on “Flora protection and plant quarantine ”

c. Generic / transmittable capacities

- Apply various sources to receive necessary information

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Discussions
- Practical and laboratory work
- Laboratory, individual and group works

14. **Assessment methods and standards**

- Oral Examination
- Individual work

15. Main literature/references

1. Վարդանյան Ժ. Հ. Ծառագիտություն. Ե., 2005, 370 էջ
2. Багдасарян А. Б. Климат Армянской ССР, Е., 1958, 140 с.
3. Варданян Ж.А. Деревья и кустарники Армении в природе и культуре, Е., 2003, 367 с.
4. Гулисашвили В. З., Махатадзе Л. Б., Прилипко Л. И. Растительность Кавказа, М. М., 1975, 304 с.
5. ՀՀ-ի կառավարության որոշումը “Բույսերի, բուսական արտադրանքի եվ կարգավորվող այլ առարկաների ներմուծման բուսասանիտարական կանոնմասին”(27.08 2001թ. N 778)
6. Բալոյան Ս. Հայաստանի արևմտարևելյան բուսական ծածկույթը: Եր, Գասպրինտ, 2005, 224 էջ:
7. Կենսաբանական բազմազանության մասին» Կոնվենցիա, հինգերորդ ազգային զեկույց, Երևան 2014, 126 էջ:
8. ՀՀ բույսերի Կարմիր գիրք (բարձրակարգ բույսեր և սնկեր): 2-րդ հրատ. /Թամանյան Կ., Արևշատյան Ի., Գաբրիելյան Է. և ուրիշներ: Թմբ. Թամանյան Կ. և ուրիշներ/, Երևան, 2010, 592 էջ:
9. Таманян К.Г., Файвуш Г.М. К вопросу о флористическом районировании Армении // Фл., растит., раст. рес. Армении, вып. 17, Ереван, 2009, с. 73-78. 1975, 304 с.
10. Красная книга Армянской ССР, Е., 1989
11. Красная книга Армянской ССР, Е., 2010

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|---|
| 1. N | |
| 2. [Title] | Probiotic Food Technology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/a week |
| 6. [Semester] | 2 nd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total)) | Lecture - 16 Practical work - 4 Seminar - 4 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Introduce knowledge on functionally and specially significant food and skills for probiotics application in food production technology • Introduce technological process and principles of specially and functionally significant milk products, probiotics production • Introduce main technological processes of specially and functionally significant food obtaining, elaboration and protection, quality requirements for food products |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Introduction, the role and significance and function of food product 2. Specially and functionally significant food products 3. Clinical aspects of probiotics, prebiotics and functional food product 4. Technologies for probiotics obtaining 5. Multi compositional probiotics technology 6. Technologies for milk and lactic acid food product obtaining 7. Technologies for milk and lactic acid probiotic beverages and bio products obtaining 8. Technologies for child food product obtaining |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p><i>a. Professional knowledge and skills</i></p> <ul style="list-style-type: none"> • Describe animal and plant origin raw product chemical composition, food, biological and |

energetic value and raw product processing technological approaches, principles and methods

- Describe specially and functionally significant food product production microbiological processes
- Classify specially and functionally significant food products, pro and prebiotics, symbiotic and describe their influential mechanisms
- Introduce pro and prebiotic containing food products production technology

b. Practical professional skills

- Apply modern methods of assessment of raw material and biological, food value, composition and properties
- Develop technology for functional nutrition products production
- Decide microbiological indicators for probiotic food products
- Master assessment methods of qualitative indicators of bio products and probiotic food products from social importance and economic effectiveness
- Assess quality requirements for technological process and ready food

c. Generic / transmittable capacities

- Apply theoretical knowledge in practice
- Analyze the acquired knowledge and make conclusions
- Apply modern IT possibilities to present the findings

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work
- Seminar discussions, individual and group works
- Laboratory

14. Assessment methods and standards

- Individual work (essay, presentation)
- Final examination: oral exam with 4 questions each 25 points (with one practical question). The number of points is 5

15. Main literature/references

1. Блинов, В.А. Общая биотехнология. Курс лекций, Ч. 2. / В.А. Блинов.– Саратов: ФГОУ ВПО «Саратовский ГАУ», 2004. – 86 с.
2. Блинов, В.А. Общая биотехнология: Методические указания к лабораторным работам / В.А. Блинов, С.Н. Буршина. – Саратов: «РИК «Полиграфия Поволжья», 2004. – 84 с.
3. Блинов, В.А. Пробиотики в пищевой промышленности и сельском хозяйстве / В.А. Блинов, С.Н. Буршина, С.В. Ковалева. – Саратов: ИЦ «Наука», 2011. – 171 с.
4. Никитина, Е.В. Микробиология (учебник) / Е.В. Никитина, С.Н. Киямова, О.А. Решетник. – СПб: ГИОРД, 2009. – 368 с.
5. Чхенкели, В.А. Биотехнология: учеб. пособие / В. А. Чхенкели. - СПб. : Проспект Науки, 2014. - 335 с.
6. Захарова, Л.А. Технология молока и молочных продуктов. функциональные продукты: / Л.А. Захарова, И.А. Мазеева. — Кемерово : КемТИПП 2014. — 107 с.

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|---|---|
| 1. N | |
| 2. [Title] | Bioengineering |
| 3. [Credits] ECTS | 6 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 4 hours/ a week |
| 6. [Semester] | 3 rd semester |
| 7. Teacher/reference person | |
| 8. distribution of hours for module activities (lectures, laboratory works, practical etc (% on total) | Lecture- 24 Practical work – 12 Seminar- 12 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Form modern thinking on main principles and methods of bioengineering • Inform student about main technologies of bioengineering and applied aspects of their usage • Introduce interdisciplinary achievements in the sphere of biology, medicine and engineering |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Types of bioengineering. 2. Current issues and methods of bioengineering. 3. Introduction to Molecular and metabolic engineering. 4. Genetic, protein and cell engineering. 5. Enzymology engineering. 6. Main principles of tissue engineering. 7. Bioengineering methods for genofond preservation |



12. [Learning outcomes of the module] DUBLIN descriptors

a. Professional knowledge and skills

- Show basics and recent achievements of bioengineering
- Describe modern research methods for solving bioengineering issues
- List cellular and gene engineering achievements among plants, animals and people
- Describe bioengineering methods for preserving natural resources

b. Practical professional skills

- Propose bioengineering issues and choose methods of experimental work
- Apply knowledge on bioengineering technologies in practice

c. generic / transmittable capacities

- Analyze facts and make justified conclusions
- Utilize scientific and methodological literature

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical work
- Seminar discussions
- experimental data analysis with computer programs

14. **Assessment methods and standards**

Գնահատման մեթոդները և չափանիշներն են.

- Individual work
- Final examination: oral exam with 4 questions each 25 points. The number of points is 5

15. **Main literature/references**

1. Фрешни, Р.Я. Культура животных клеток [Электронный ресурс] / Р. Я. Фрешни. - М : Бином. Лаборатория знаний, 2013. - 691 с Режим доступа: ЭБС "Издательство "Лань". - Неогранич. доступ. - ISBN 978-5-9963-1342-6
2. Белькова Н. Л. Большой практикум по биоинженерии и биоинформатике : учеб.-метод. пособие : в 3 ч. / Н. Л. Белькова. Иркутск : Изд-во ИГУ, 2013 - ISBN 978-5-9624-0956-6. Ч. 2 : Нуклеиновые кислоты. - 2014. - 155 с. ISBN 978-5-9624-1184-2.(39 экз.)
3. Молекулярно-генетические и биохимические методы в современной биологии растений [Электронный ресурс]. – ЭВК. – М. : Бином. Лаборатория знаний, 2012. - Режим доступа ЭБС "Издательство "Лань". Неогранич. доступ. - ISBN 978-5-9963-09
4. Нефедова, Л.Н. Применение молекулярных методов исследования в генетике: учебное пособие / Л.Н. Нефедова. – Москва: НИЦ Инфра-М, 2012. – 104 с. [Электронный ресурс] <http://znanium.com/bookread.php?book=302262> (Дата обращения: 01.02.2015).

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|--|
| 1. N | ----- |
| 2. [Title] | Pharmacognosy |
| 3. [Credits] ECTS | 6 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 3 hours/ a week |
| 6. [Semester] | 3 rd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 18 Practical work - 10 Seminar – 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> Teach students the types of medical herbs, structural features, biologically active substances used in raw materials, as well as medicament forms Galen from herbal raw materials and their healing properties |
| 11. [Module brief content] | <ol style="list-style-type: none"> Pharmacognosy: science and subject Historical development Basics of the procurement of herbal raw materials Crushing stages and organizations engaged in raw material processing. Medical herb collection rules Toxic medical herbs collection Methods of drying medical herbs Drying modes of different plant organs Driers Quality control of medical herbs through relevant analyzes (macroscopic, microscopic, pharmacological) Quality determination of pharmaceutical raw materials: raw materials obtained through relevant standard measures |

12. Packaging of medical herbs
13. Selection of the right type of container and package depending on the type and quality of raw materials
14. Preservation of herbal raw materials
15. Factors affecting the quality of stored raw materials
16. Requirements for maintenance centers according to the NPP
17. Raw materials and herbs containing sugar and fats
18. Herbs and raw materials containing glycosides
19. Bitter substances
20. Raw materials and herbs containing terpenoids
21. Raw materials and herbs containing vitamins
22. Raw materials and herbs containing saponins
23. Raw materials and herbs containing phenol compounds
24. Raw materials and herbs containing flavonoids
25. Raw materials and herbs containing cardiac glycoside

12. [Learning outcomes of the module] DUBLIN descriptors

a. Professional knowledge and perception

- Describe the basics of medical herbal raw material procurement, plant pharmacological groups
- Classify medical herbs according to impact
- Explain the therapeutic effects of medical herbs based on their structure

b. Professional practical skills

- Distinguish medical herbal raw materials, according to chemical structure
- Determine the selection of plant organs containing biologically active substances accurately
- Master medical herbs and their medicinal significance in Armenian, Russian, Latin

c. Generic / transmitted capabilities

- Use different sources to obtain the necessary information
- Analyze the facts and make reasonable conclusions
- Uphold professional ethics

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- lectures
- practical work
- seminar discussions, individual and group work

14. **Assessment methods and standards**

- Individual work (abstracts, slideshows)
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5

15. **Main literature/references**



1. M. A Kuznetsova, I.J. Ribachuk "Pharmacognosy", Introduction, Moscow, 1984
2. I. N. Mokolsky, N. A. Besspalova, N. A. Mamilina, Moscow, 2003,.
3. Muraviova D. A., Samilina I. A., Yakovlev G.P . Torosyan's "Herbs of Armenia" Green Tablet

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|---|--|
| 1. N | |
| 2. [Title] | Herbal Medicinal Preparation Technology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/ a week |
| 6. [Semester] | 3 rd semester |
| 7. Teacher/reference person | |
| 8. distribution of hours for module activities (lectures, laboratory works, practical etc (% on total) | Lecture - 12 Practical work - 6 Laboratory works - 6 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Teach students the technological processes and basics of medicines preparation • Present the action of processing pharmaceutical products to drugs |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. The main problems of pharmaceutical technology. 2. Pharmaceutical technology and its connection to other fields of science 3. Solid drugs 4. Mild drugs 5. Liquid drugs 6. Other drugs |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p>a. Professional knowledge and perception</p> <ul style="list-style-type: none"> • Present the composition and properties of herbal medicines and their pharmaceutical effects and application • Explain modern technologies of medical herbal forms recultivation • Describe properties of medical forms and their biological safety and stability requirements <p>b. Professional practical skills</p> <ul style="list-style-type: none"> • Interpret the precise requirements of the technological modes of medicinal raw materials |

- Differentiate medicine recycling methods of forms (solid, liquid, mild etc)

c. general / transmitted capabilities

- Utilizedifferent sources to obtain the necessary information

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work

14. **Assessment methods and standards**

- Individual work (abstracts, slideshows)
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5

15. **Main literature/references**

1. Butenko R.G. Biology of cells of higher plants based on vitro and biotechnology: Proc. manual. - M.: FBK-PRESS, 1991. - 160 pages.
2. Kalinin F.L., Kushnir G.P., Sarnatskaya V.V. Technology of microclonal propagation of plants - Kiev: Naukova Dumka, 1992.
3. Basics of biotechnology: Textbook. Allowance for higher. ped. Studies. Institutions / T.A. Yegorova, S.M. Klunova, E.A. Zhivukhina. - M.: Publishing Center "Academy", 2003. - 208 pages.
4. Agricultural biotechnology: Textbook. / V.S. Shevelukha, E.A. Kalashnikova, S.V. Degtyarev et al.: Pod. Ed. V.S. Shiveruhi. - M.: Higher.199 – 416pages

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|--|--|
| 1. N | |
| 2. [Title] | Vegetable Raw Material Bioconversion Technology |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/ a week |
| 6. [Semester] | 3 rd semester |
| 7. Teacher/reference person | |
| 8. Distribution of hours for module activities (lectures, laboratory works, practical etc. (% on total) | Lecture - 12 Practical work - 4 Laboratory works - 8 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Provide knowledge about the chemical composition of herbal raw material and its main types of bioconversion (physical, chemical, biological) • Introduce the basics of wasted technology in food industry |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. General concept of herbal raw materials used in biotechnological processes 2. Classification of raw materials 3. Theoretical basics of bioconversion of vegetative raw materials 4. Classification of bioconversion methods of vegetative raw materials 5. Bioconversion means of vegetative raw materials (physical and combined, chemical, biological) 6. The basics of food wasted industry technologies 7. Biofuel production |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p>a. Professional knowledge and perception</p> <ul style="list-style-type: none"> • Present chemical composition of food raw material of vegetative origin • Describe the basic technology of vegetative bioconversion • Explain the approaches to the creation of low-wasted technologies in biotechnology and food industry • Describe important microbiological processes during recycling and preservation of |

vegetable raw materials

b. Practical professional skills

- Select biochemical, chemical and physical methods of food quality assessment
- Apply the gained knowledge during the solvation of specific environmental issues
- Master the technique of conducting basic research on the quality of raw materials, prefabrications and ready products
- Planning the selection of equipment to ensure the smooth production

c. Generic/ transmitted capabilities

- Analyze facts and make reasonable conclusions
- Apply theoretical knowledge in practice

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical and laboratory work

14. Assessment methods and standards

- Individual work (presentation of experimental data analysis)
- Final exam: oral test, the questionnaire contains 4 questions - each 25 points. The step score is 5.

15. Main literature/references

1. Sushkova VI, Vorobyeva G.I. Infrequent conversion of rational straw in biologically active items. - Kirov, - 204pages. 2007
2. Neverova O., Prosekkov A.Yu. Poultry biotechnology products from chips rastith. exit: Ucheb /. - M: NIT INFRA-M, 2014. - 318 pages
3. Sinitsyn AP, Gusakov AV, Chernoglazov VM Bioconversion of lignocellular material, Publisher of Moscow University, Moscow, 1995- 224pages.

UNIVERSITY: Shirak State University
DEPARTMENT: Mathematics and Natural Sciences
STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|---|--|
| 1. N | |
| 2. [Title] | Technology of Biological Active Additives from Vegetable Raw Materials |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week | 2 hours/ a week |
| 6. [Semester] | 3 rd semester |
| 7. Teacher/reference person | |
| 8. distribution of hours for module activities (lectures, laboratory works, practical etc (% on total) | Lecture- 12 Practical work- 6 Laboratory works- 6 |
| 9. [Assessment type] | Oral examination Individual work |
| 10. [The aim of the module, general] | <ul style="list-style-type: none"> • Provide knowledge and form skills on ways and methods of making biologically active(BAA) additives with primary and secondary plant based raw material • Form abilities to make decisions on expediency, permissibility and information security of BAA usage |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Theoretical bases of BAA obtaining from plant based raw material and their usage 2. Regulations for BAA production 3. Classification, chemical composition of BAAs, principles and risks of their usage 4. Requirements for plant based raw materials for BAA production 5. General description and classification of herbal raw materials 6. Structure and chemical composition of plant cell 7. BAA receipts development principles and production requirements 8. Raw materials processing technologies and extraction of biological active substances(BAS) from plants 9. Specifications of some BAS extraction technological processes for BAA production 10. Production groups 11. Phases of technological processes 12. Main production groups 13. Production control organization 14. BAA standardization criteria |

- 15. BAS authenticity indicators
- 16. BAA impact on human health
- 17. Biochemical and pharmacological aspects of BAS impact on health

12. [**Learning outcomes of the module**] DUBLIN descriptors

a. Professional knowledge and skills

- Describe functional components and properties in vegetarian raw materials
- Explain forming mechanisms of biologically active properties in ready BAAs'
- Describe main methods of active substance separation, condensation and maintenance from natural raw materials
- Submit processing technological methods to get functional production from secondary vegetarian raw materials
- List main types of modern biological additives and perspectives of making new BAAs'.

b. Practical professional skills

- Justify rational methods of BAA extraction from vegetarian raw material considering their type and properties
- Create product with functional properties in accordance with current document requirements
- Control quality, identity and security of vegetarian raw material additives

c. Generic / transmittable capacities

- Implement gained theoretical knowledge in practice

13. **Teaching and Learning methods** (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Practical work
- Experimental data analysis with computer programs

14. **Assessment methods and standards**

- Individual work
- Final examination: oral exam with 4 questions each 25 points (with one practical question). The number of points is 5

15. **Main literature/references**

1. Иванова, Л. А. Пищевая биотехнология : учеб. пособие / Л. А. Иванова, Л. И. Войно, И. С. Иванова ; ред. И. М. Грачева. - Москва : КолосС, 2008 - . Кн. 2 : Переработка растительного сырья. - 472 с.
2. Коваленко, Л. В. Биохимические основы химии биологически активных веществ: учеб. пособие / Л. В. Коваленко. - Москва : БИНОМ. Лаборатория знаний, 2012. - 230 с.
3. Мезенова, О.Я. Гомеостаз и питание : учеб. пособие / О. Я. Мезенова. - Москва : Колос, 2010. - 318 с.
4. Функциональные продукты питания : учеб. пособие / Р. А. Зайнуллин [и др.]. - Москва : КНОРУС, 2012. - 304 с.

UNIVERSITY: Shirak State University

FACULTY/DEPARTMENT: Department -Natural Sciences and Mathematics

STUDY PROGRAMME: Biotechnology

MODULE DESCRIPTOR

| | |
|---|---|
| 1. N | |
| 2. [Title] | Start-up |
| 3. [Credits] ECTS | 3 ECTS |
| 4. Language | Armenian |
| 5. [Hour per week] hours/week. | 4 hours/ week |
| 6. [Semester] | 3-rd semester |
| 7. Teacher/reference person | |
| 8. distribution of hours for module activities (lectures, laboratory works, practical etc (% on total) | Lectures - 24 Practical work - 24 |
| 9. [Assessment type] | <ul style="list-style-type: none"> • written examination • Individual work |
| 10. [The aim of the module, general] | Develop start-up knowledge and skills amongst students |
| 11. [Module brief content] | <ol style="list-style-type: none"> 1. Basis for the creation of startups and their characteristics 2. Startup development stages 3. Market research for startup 4. Startup Investments 5. Creating startups by using tools and project management methodology 6. Entrepreneurs and Personality 7. Website, logo and naming 8. Presentation and public speaking skills for pitching 9. Startup Management 10. Startup Finance 11. Multicriteria model for assessing the quality of startups |
| 12. [Learning outcomes of the module] DUBLIN descriptors | <p>At the end of the course the student will be able to:</p> <p>a. professional knowledge and knowledge;</p> <ul style="list-style-type: none"> • Identify key concepts and features of the startup, • Describe the Startup's key points. |

b. practical professional skills

- Form and develop an innovative idea,
- Form a talented and efficient startup team,
- Conduct research and surveys of the target audience on their own (testing),
- Develop a development strategy, and a justified and implemented business plan,
- Use all possible ways to raise capital for the development and scaling of startups,
- Conduct a startup assessment.

c. general / transmitted capabilities

- Be able to use Start-up creation methodologies and tools ranging from idea generation to teamwork and market placement

13. Teaching and Learning methods (e.g. Lectures, Case study, Role playing and discussion, team/group projects...)

- Lectures
- Case study
- Practical work
- Team/group project

14. Assessment methods and standards

- Individual work (some Start-up)
- Final exam: written examination, the questionnaire contains 3 questions - 30, 30, 40 points.

15. Main literature/references

- Музыченко В.В. HR в СТАРТАПе: Практическое пособие / В.В. Музыченко. - М.: НИЦ ИНФРА-М, 2015. - 224 с
- Токарев Б. Е. Маркетинг инновационно-технологических стартапов: от технологии до коммерческого результата /Б. Е. Токарев. , М. : Магистр : ИНФРА-М, 2018. - 264 с.
- Смирнов С.Е. Бизнес-планирование : учебник / под ред. проф. Т.Г. Попадюк, проф. В.Я. Горфинкеля. , М. :Вузовский учебник : ИНФРА-М, 2018. ,296 с.
- Бронникова Т.С. Разработка бизнес-плана проекта : учеб. пособие / Т.С. Бронникова. ? 2-е изд., перераб. и доп.? М. : ИНФРА-М, 2018. , 215 с.
- Горбунов В. Л. Бизнес-планирование с оценкой рисков и эффективности проектов: Научно-практическое пособие / Горбунов В. Л. - М.: ИЦ РИОР, НИЦ ИНФРА-М, 2018. - 248 с.
- Лукасевич И.Я. Инвестиции : учебник / И.Я. Лукасевич. ? М. : Вузовский учебник : ИНФРА-М, 2018. , 413 с.
- Harris T., Start-up: A Practical Guide to Starting and Running a New Business, 2006, 165 pages
- Maurya Ash, Running Lean: Iterate from Plan A to a Plan That Works., 2010, 239pages
- Ries Eric, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses,2011, 336 pages